1 (presently amended). A method for converting a first light beam having a first frequency into a second light beam having a second frequency, the method comprising:

providing an optical cavity that is defined by a cavity axis and first and second mirrors, spaced apart along the axis , and by first and second nonlinear crystals, spaced apart along the axis between the first and second mirrors, wherein each of the first mirror and the second mirror is substantially fully transmitting at each of frequencies ω and 3ω and is substantially fully reflecting at a frequency 2ω, where ω is a selected frequency;

providing a laser pump beam having pump photons with associated frequency 3ω within the cavity;

allowing at least one pump photon to pass through and interact with a first crystal, positioned within the cavity, and to undergo a conversion to a first-converted photon and a ~~first~~ second-converted photon, having substantially the respective frequencies 2ω and ω; ~~and~~

allowing the first-converted photon to pass through and interact with a second crystal, positioned within the cavity, and to undergo a conversion to ~~second and third second-converted~~ a third-converted photon and a fourth-converted photon[[s]], each having a frequency substantially equal to ω ; and

allowing the second-converted photon to pass through the second crystal,

whereby the pump photon is converted to three photons, each with a frequency substantially equal to ω , each of which exits from the cavity through at least one of the first mirror and the second mirror.

2 (canceled). The method of claim 1, further comprising allowing at least one of said second converted photons to exit from said cavity through at least one of said first mirror and said second mirror.

3 (canceled). The method of claim 2, further comprising configuring at least one of said first mirror and said second mirror to be substantially fully transmitting

at each of said frequencies ω and 3ω and to be substantially fully reflecting at said frequency 2ω.

4 (presently amended). The method of claim [[2]] 1, further comprising providing at least one light-receiving surface of at least one of said first crystal and said second crystal with an anti-reflective coating for said frequency 2ω.

5 (original). The method of claim 1, further comprising providing at least one light-receiving surface of at least one of said first crystal and said second crystal with an anti-reflective coating for at least one of said frequencies 3ω and ω.

6 (original). The method of claim 1, further comprising providing said first mirror at a first selected end of said first crystal and providing said second mirror at a second selected end of said second crystal.

7 (original). The method of claim 1, further comprising:

providing said first nonlinear crystal having a length d(1) and having a refractive index n(2ω;1) for incident light having said frequency 2ω;

providing said second nonlinear crystal having a length d(2) and having a refractive index n(2ω;2) for incident light having said frequency 2ω; and

providing said optical cavity with a selected length D that satisfies the relation

$$\{D + d(1)\cdot(n(2\omega;1) - 1) + d(2)\cdot(n(2\omega;2) - 1)\}\cdot(2\omega/c) = N2\cdot\pi,$$

where N2 is a selected positive integer.

8 (original). The method of claim 1, further comprising providing said pump photon from a light source drawn from a group consisting of Nd:glass, Nd:YAG, Nd:$YAlO_3$, Nd:YVO_x, Ho:YLF and Ti:Al_2O_3 .

9 (original). The method of claim 1, further comprising providing at least one of said first crystal and said second crystal from a group of crystals consisting of

$LiNbO_3$, $LiIO_3$, $KTiOPO_4$, $RbTiOAsO_4$, $CsH_yD_{2-y}AsO_4$, β-BaB_2O_4, $Ba_2NaNb_{35}O_{15}$, Ag_2AsS_3, $AgGaS_2$, $AgGaSe_2$, GaAs and $ZnGeP_2$.

10 (presently amended). A system for converting a first light beam having a first frequency into a second light beam having a second frequency, the system comprising:

an optical cavity that is defined by a cavity axis and first and second mirrors spaced apart along the axis , and by first and second nonlinear crystals, spaced apart along the axis between the first and second mirrors, wherein each of the first mirror and the second mirror is configured to be substantially fully transmitting at each of frequencies ω and 3ω and to be substantially fully reflecting at a frequency 2ω, where ω is a selected frequency;

a light source that provides a pump laser beam having photons with associated frequency 3ω within the cavity;

a first nonlinear crystal and a second nonlinear crystal, positioned along the axis within the cavity and configured so that:

at least one pump photon passes through and interacts with the first crystal and undergoes a conversion to a first-converted photon and a ~~first~~ second-converted photon, having substantially the respective frequencies 2ω and ω; ~~and~~

the first-converted photon passes through and interacts with the second crystal and undergoes a conversion to ~~second and third second-converted~~ a third-converted photon and a fourth-converted photon[[s]], each having a frequency substantially equal to ω ; and

the second-converted photon passes through the second crystal,

whereby the pump photon is converted to three photons, each with a frequency substantially equal to ω , each of which exits from the cavity through at least one of the first mirror and the second mirror.

11 (canceled). The system of claim 10, wherein said first and second nonlinear crystals are configured so that at least one of said second-converted photons exits from said cavity through at least one of said first mirror and said second mirror.

12 (canceled). The system of claim 11, wherein at least one of said first mirror and said second mirror is configured to be substantially fully transmitting at each of said frequencies ω and 3ω and to be substantially fully reflecting at said frequency 2ω.

13 (presently amended). The system of claim [[11]] <u>10</u>, wherein at least one light-receiving surface of at least one of said first crystal and said second crystal is coated an anti-reflective coating for said frequency 2ω.

14 (original). The system of claim 11, wherein at least one light-receiving surface of at least one of said first crystal and said second crystal is coated an anti-reflective coating for at least one of said frequencies 3ω and ω.

15 (original). The system of claim 10, wherein said first mirror and said second mirror are positioned at a first selected end of said first crystal and at a second selected end of said second crystal, respectively.

16 (original). The system of claim 10, wherein:

said first nonlinear crystal has a selected length d(1) and has a refractive index n(2ω;1) for incident light having said frequency 2ω;

said second nonlinear crystal has a selected length d(2) and has a refractive index n(2ω;2) for incident light having said frequency 2ω; and

said optical cavity has a selected length D that satisfies the relation

$$\{D + d(1)\cdot(n(2\omega;1) - 1) + d(2)\cdot(n(2\omega;2) - 1)\}\cdot(2\omega/c) = N2\cdot\pi,$$

where N2 is a selected positive integer.

17 (original). The system of claim 10, wherein said light source is drawn from a group consisting of Nd:glass, Nd:YAG, Nd:$YAlO_3$, Nd:YVO_x, Ho:YLF and Ti:Al_2O_3 .

18 (original). The system of claim 10, wherein at least one of said first crystal and said second crystal is drawn from a group of crystals consisting of $LiNbO_3$, $LiIO_3$, $KTiOPO_4$, $RbTiOAsO_4$, $CsH_yD_{2-y}AsO_4$, β-BaB_2O_4, $Ba_2NaNb_{35}O_{15}$, Ag_2AsS_3, $AgGaS_2$, $AgGaSe_2$, GaAs and $ZnGeP_2$.

19 (presently amended). A method for converting a first light beam having a first frequency into a second light beam having a second frequency, the method comprising:

providing an optical cavity that is defined by a cavity axis and first and second mirrors spaced apart along the axis , and by first and second nonlinear crystals, spaced apart along the axis between the first and second mirrors, wherein each of the first mirror and the second mirror is substantially fully transmitting at each of frequencies ω and 4ω and is substantially fully reflecting at a frequency 2ω, where ω is a selected frequency;

providing a laser pump beam having pump photons with associated frequency ~~3ω~~ 4ω within the cavity;

allowing at least one pump photon to pass through and interact with a first crystal and to undergo a conversion to a ~~first~~ first-converted photon and a second~~first~~-converted photon, each having ~~the respective frequencies 2ω and~~ a frequency substantially equal to 2ω; ~~and~~

allowing at least one of the ~~first~~ first-converted photon and the second~~first~~-converted photon to pass through and interact with a second crystal and to undergo a conversion to a ~~second-converted photon at least one of,~~ third-converted photon and a fourth-converted photon, each of the third-converted and fourth-converted photon having a frequency substantially equal to ω, and

whereby the pump photon is converted to at least two photons, each with a frequency substantially equal to ω , and each of which exits from the cavity through at least one of the first mirror and the second mirror.

20 (original). The method of claim 19, further comprising:

allowing each of said first first-converted photon and said second first-converted photon to pass through and interact with said second crystal, positioned within said cavity, and to undergo a conversion to first and second second-converted photons, each having a frequency substantially equal to ω,

whereby the pump photon is converted to at least four photons, each with a frequency substantially equal to ω.

21 (canceled). The method of claim 19, further comprising allowing at least one of said second-converted photons to exit from said cavity through at least one of said first mirror and said second mirror.

22 (canceled). The method of claim 21, further comprising configuring at least one of said first mirror and said second mirror to be substantially fully transmitting at each of said frequencies ω and 4ω and to be substantially fully reflecting at said frequency 2ω.

23 (presently amended). The method of claim [[21]] 19, further comprising providing at least one light-receiving surface of at least one of said first crystal and said second crystal with an anti-reflective coating for said frequency 2ω.

24 (original). The method of claim 19, further comprising providing at least one light-receiving surface of at least one of said first crystal and said second crystal with an anti-reflective coating for at least one of said frequencies 4ω and ω.

25 (original). The method of claim 19, further comprising providing said first mirror at a first selected end of said first crystal and providing said second mirror at a second selected end of said second crystal.

26 (original). The method of claim 19, further comprising:

providing said first nonlinear crystal having a length d(1) and having a refractive index n(2ω;1) for incident light having said frequency 2ω;

providing said second nonlinear crystal having a length d(2) and having a refractive index n(2ω;2) for incident light having said frequency 2ω;

providing said optical cavity with a selected length D that satisfies the relation

$$\{D + d(1)\cdot(n(2\omega;1) - 1) + d(2)\cdot(n(2\omega;2) - 1)\}\cdot(2\omega/c) = N2\cdot\pi,$$

where N2 is a selected positive integer.

27 (original). The method of claim 19, further comprising providing said pump photon from a light source drawn from a group consisting of Nd:glass, Nd:YAG, Nd:$YAlO_3$, Nd:YVO_x, Ho:YLF and Ti:Al_2O_3 .

28 (original). The method of claim 19, further comprising providing said first crystal from a group of crystals consisting of $LiNbO_3$, $LiIO_3$, $KTiOPO_4$, $RbTiOAsO_4$, $CsH_yD_{2-y}AsO_4$, β-BaB_2O_4, $Ba_2NaNb_{35}O_{15}$, Ag_2AsS_3, $AgGaS_2$, $AgGaSe_2$, GaAs and $ZnGeP_2$.

29 (presently amended). A system for converting a first light beam having a first frequency into a second light beam having a second frequency, the system comprising:

an optical cavity that is defined by a cavity axis and first and second mirrors spaced apart along the axis <u>, and by first and second nonlinear crystals, spaced apart along the axis between the first and second mirrors, wherein each of the first mirror and the second mirror is substantially fully transmitting at each of frequencies ω and 4ω and is substantially fully reflecting at a frequency 2ω, where ω is a selected frequency</u>;

a light source that provides a pump laser beam having photons having an associated frequency 4ω within the cavity;

a first nonlinear crystal and a second nonlinear crystal, positioned along the axis within the cavity and configured so that:

the pump photon passes through and interacts with the first crystal and undergoes a conversion to a ~~first~~ first-converted photon and a second~~first-~~converted photon, each having ~~the respective frequencies 2ω and~~ a frequency substantially equal to 2ω; and

at least one of the ~~first~~ first-converted photon and the second~~first-~~converted photon passes through and interacts with the second crystal and undergoes a conversion to ~~first and second second-converted photons~~ a third-converted photon and a fourth-converted photon, each of the third-converted photon and fourth-converted photon having a frequency substantially equal to ω,

whereby the pump photon is converted to at least two photons, each with a frequency substantially equal to ω , and each of which exits from the cavity through at least one of the first mirror and the second mirror.

30 (presently amended). The ~~method~~ system of claim 29, wherein said first and second nonlinear crystals are configured so that

each of said ~~first~~ first-converted photon and said second~~first-~~converted photon passes through and interacts with said second crystal and undergoes a conversion to first and second second-converted photons, each having a frequency substantially equal to ω,

whereby the pump photon is converted to at least four photons, each with a frequency substantially equal to ω.

31 (canceled). The system of claim 29, wherein said first and second nonlinear crystals are configured so that at least one of said second-converted photons exits from said cavity through at least one of said first mirror and said second mirror.

32 (canceled). The system of claim 31, wherein at least one of said first mirror and said second mirror is configured to be substantially fully transmitting at each of said frequencies ω and 4ω and to be substantially fully reflecting at said frequency 2ω.

33 (presently amended). The system of claim [[31]] 29, wherein at least one light-receiving surface of at least one of said first crystal and said second crystal is coated an anti-reflective coating for said frequency 2ω.

34 (presently amended). The system of claim [[31]] 29, wherein at least one light-receiving surface of at least one of said first crystal and said second crystal is coated an anti-reflective coating for at least one of said frequencies 4ω and ω.

35 (original). The system of claim 29, wherein said first mirror and said second mirror are positioned at a first selected end of said first crystal and at a second selected end of said second crystal, respectively.

36 (original). The system of claim 29, wherein:

said first nonlinear crystal has a selected length d(1) and has a refractive index n(2ω;1) for incident light having said frequency 2ω;

said second nonlinear crystal has a selected length d(2) and has a refractive index n(2ω;2) for incident light having said frequency 2ω; and

said optical cavity has a selected length D that satisfies the relation

$$\{D + d(1)\cdot(n(2\omega;1) - 1) + d(2)\cdot(n(2\omega;2) - 1)\}\cdot(2\omega/c) = N2\cdot\pi,$$

where N2 is a selected positive integer.

37 (original). The system of claim 29, wherein said light source is drawn from a group consisting of Nd:glass, Nd:YAG, Nd:$YAlO_3$, Nd:YVO_x, Ho:YLF and Ti:Al_2O_3.

38 (original). The system of claim 29, wherein at least one of said first crystal and said second crystal is drawn from a group of crystals consisting of $LiNbO_3$, $LiIO_3$, $KTiOPO_4$, $RbTiOAsO_4$, $CsH_yD_{2-y}AsO_4$, β-BaB_2O_4, $Ba_2NaNb_{35}O_{15}$, Ag_2AsS_3, $AgGaS_2$, $AgGaSe_2$, GaAs and $ZnGeP_2$.